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ABSTRACT

Social science theorists such as Lewin, Campbell, and Wimsatt have established the basis for scientific community psychology and in particular mathematical psychology. Their tools of triangulation and robustness analysis have furthered the methodology by defining the logical effects of mathematical concepts in a theoretical system. Mathematical psychology can contribute to support systems work in bridging the current gap between qualitative-theoretical emphases and quantitative-methodological emphases. Theory construction in the tradition of action research is seriously lacking in the field and is important for reasons of research adequacy. Theory construction tasks are unique, given that mathematical psychology is defined by the use of sophisticated mathematical methods rather than a particular topic area. Mathematical modeling can make valuable contributions to the development of theory (discursive), can clarify and extend concepts (explicational), can describe data sets (representational) and formally can define concepts as related to data sets (theoretical-construct). These models can facilitate communication between applied researchers and target systems. (BL)

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THEORY CONSTRUCTION PRINCIPLES IN APPLIED RESEARCH: CAN WE LEARN FROM (OTHERS') MISTAKES?

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INTRODUCTION

Community psychologists are mobilizing the resources of academic psychology and social science as contributions to community psychology research and practice (e.g. Gibbs, Lachenmeyer & Sigal, 1980; Heller, 1979; Masterpasqua, 1981). A multitude of classic issues in applied social science are relevant to these efforts. We want to suggest that some of these issues were successfully confronted by Kurt Lewin in his action research model. In attempting to learn from Lewin's creativity, theory construction priniciples will be offered as important tools for integrative efforts in applied science. The general thesis will be illustrated by examining potential contributions of mathematical psychology to support systems interventions.

Terminological issues are of importance here because of variabilities in usage in the theory contruction literature. For our present purposes we shall use "theory construction" to refer broadly to the systematic, explicit development of conceptual frameworks in science, research, and application. We will focus on the literature addressing such issues in the psychological and social scientific literature to the exclusion of philosophers' discussions (but see McDonald, Note 1, for a brief discussion of a few contributions by philosophers). The distinctions between theory construction and methodology in its broadest sense are quite vague. These terms will be used arbitrarily to distinguish between an emphasis on theory building on the one hand versus emphases on research design, data analysis, and assessment issues on the other hand. Unfortunately, precise definition of terms in this area is a major task given the multitude of perspectives available. The meaning used here is designed to emphasize the importance of systematic and explicit consideration of issues with which all community psychologists deal, usually in an implicit fashion.

I. Lewin: a lesson for applied scientists

Tension between application and research is not a recent development. It would seem historical perspectives could offer lessons of value today. Social scientists have a resource for this area in the work of Kurt Lewin (see Campbell, 1978; Cartwright, 1978; Ketterer, Price & Politser, 1980; Lewin, 1946; 1947; Bataille & Clanet, 1981). We see Lewin's work as important to community psychologists for several reasons.

First, he was a very productive psychologist with emphases in both application and knowledge generation. Second, he helped establish the Commission on Community Interrelations, a project whose work could well stand as a model for social action research as promoted by community psychology (see Marrow, 1969). The projects taken on included problems in racial conflict and social prejudice. Reading this work in conjuction with today's literature strikes us as occasion for nominating Lewin as father of "scientific community psychology." In particular, this work served as an important substantive focus for his development of the action research paradigm, exemplifying his synthesis of applied and research interventions. The third point which recommends Lewin for our consideration is his particular relevance to the specific example discussed below. His emphasis upon the use of mathematics in social science earned coverage of his work in one of the classic works of mathematical psychology (Miller, 1964). Miller notes, moreover, that while Lewin's use of mathematics did not meet the standards of many colleagues, his contribution to the field is significant in its own right. Lewin is also intimately associated with the rise of social network analysis, both through the work of his students and his own work (e.g. Barnes, 1969; Turk, 1978). Turk notes, however, that Lewin's influence in the rise of social network analysis is unacknowledged by an important work in community psychology. Lewin's historical connections with mathematical

psychology and social networks and the obscurity of such observations highlight our point that his contributions may be underestimated.

The principal lesson from Lewin's work is the importance of theory construction. Lewin's early interest in philosophy of science continued throughout his career to be expressed in active concern with developing principles for making "good" theory. This emphasis was the unifying force behind his synthesis of intervention in extant social systems with scientific theory building. For example, one principle he developed was the importance of the total situation in examining a given event or process (cf. Deutch, 1968). He also promoted a gradual approximation approach to theory building: start global and refine concepts as additional research is accomplished. Although his approaches contrast starkly with much contemporary literature, they are the foundations on which action research developed (cf. Baltes & Willis, 1977).

It is not so much Lewin's own theory or even his principles of theory construction which occupy us here. Rather, it is the observation that Lewin's resolutions to the tensions between science and application were based on systematic, creative theory construction on his part. We suggest that community psychology's methodological literature is incomplete due to a lack of consideration of theory construction issues. Of course, uncritical adoption of Lewin's or anyone else's principles of theory construction is not an adequate solution.

II. Resources available for theory construction in community psychology.

Although Lewin's example is suggestive, it does not supply a very broad literature base in action research because of Lewin's untimely death (Cartwright, 1978). The purpose of this section is to describe a few of the many resources available to community psychologists seeking to enrich their understanding of

theory construction principles. For the sake of brevity, the more well-known methodological literature of importance to present purposes will be passed over (e.g. continued contributions to the construct validity literature; Messick, 1981).

The importance of Don Campbell's work in traditional methodology and program evaluation is highly recognized in community psychology. One rarely sees references, however, to the broader aspects of his theory construction work (e.g. Campbell, 1966). This is all the more surprising in the instances of his theory construction work which are intimately associated wtih well known methodological principles For example, his "triangulation" principle in basic to the multitrait-multimethod matrix (Campbell & Fiske, 1959). The basic notion behind triangulation is that the use of multiple, independent methods (perspectives, measurements, etc.) permits the researcher to sort out the unique "biases" of each method from the effects of the phenomena (objects, traits) under study. The uses of triangulation in defining social groups (Campbell, 1958) or in theoretical development (Campbell, 1966) are less well known.

The importance of Campbell's work is highlighted through its extension by one of his students (Wimsatt, 1981). Wimsatt uses the term "robustness" to describe the hardy nature of theoretical concepts established through triangulation processes. One observation is of particular relevance to community psychologists interested in mathematical psychology. Wimsatt explains the particular power of mathematical theory as due to the far reaching logical "effects" of mathematical concepts in a theoretical system. In other words, the deductive structures of mathematics yields stronger sequences of consequence than do "fuzzier" verbal notions. Moreover, Wimsatt points out an oft noted weakness of mathematical theory (triviality) can be seen as a result of redundant assumptive bases. Without belaboring his analysis, we

suggest that Campbell and Wimsatt's work promises to aid community psychologists in sophisticated theoretical development.

Other examples of rich theory construction work are available to community psychologists in recent debates in organizational and social psychological literatures. Argyris (1980) provides an extensive critique of social experimentation methodology based on his work in organizational studies. In a slightly different vein, Gergen (1982) has synthesized his view of the "social psychology as history" debate in the context of extensive methodological and theory construction developments. Turner (1981) provides a helpful discussion of the value of traditional research approaches in applied social psychology in contrast to Argyris and Gergen. These recent works provide a stimulating introduction to theory construction and methodology at the social systems level of analysis, an invaluable basis for community psychologists.

Beyond extensive debates, Mitroff and Kilmann(1978) have offered a perspective which potentially synthesizes the perspectives of the competing factions represented above. Basically, these authors suggest that science is a social process influenced by the personalities of the researchers, the demands of various facets of research, and the socio-historical context of the work. These organizational researchers have integrated the intervention-application phases of applied research into their model. Mitroff and Kilmann provide (a) an important stimulus to theory construction work, (b) a rationale for synthesizing conflicting traditions in applied social science, and (c) a view of the importance of application in research processes. With regard to the latter point, their approach is entirely consistent with Lewinian action research.

The work mentioned above is merely illustrative of vast resources available to community psychologists (cf. Cole, 1976). The literatures in developmental psychology (e.g. Baltes & Willis, 1977; Overton & Reese, 1981), cross-cultural

psychology (e.g. Landis & Brislin, 1983; Triandis & Berry, 1980) and clinical psychology (e.g. Mahoney, 1981; Meehl, 1978) are other essential resources (cf. McDonald, Note 1). The systematic consideration of issues in applied science and action research are topics of international scope (cf. Bataille & Clanet, 1981) which cross theoretical boundaries (cf. Glaser, 1980; Mitroff & Kilmann, 1978; Ross, 1981). In short, there are extensive resources available for community psychologists willing to accept the challenge.

The general issues of theory construction in applied social science can be argued at length (McDonald, Note 1). For our purposes, however, it is more important to examine a current case in point. On the one hand, mathematical psychology might seem like the epitome of esoteric academia. On the other hand, the complexities of support system dynamics call for the most powerful, most complete set of approaches community psychology can muster. We shall briefly examine some of the contributions theory construction perspectives can make to a "union" between these areas of study.

III. An example: Mathematical psychology and support systems research.

Following the Lewinian example, it is suggested here that mathematical psychology can, with the aid of active theory construction, be of value in applied support networks research. Following Gottlieb (1981) we shall focus at the network level of analysis for two reasons. First, it is a popular topic among community psychologists. Second, there is an extensive interdisciplinary literature in the area. In this section we shall examine some background from social network analysis and then use a theory construction perspective to suggest contributions of mathematical psychology to support systems work. The issues raised here are discussed in more detail by McDonald (Note 1).

A. Social network analysis

Although community psychologists are just "discovering" the field, anthropologists and sociologists have been developing various facets of social network analysis since the 1950s.

Psychologists interested in sociometry have made major contributions to the field, but psychology has had marginal input to more recent developments with but a few exceptions (e.g. Arabie, Boorman & Levitt, 1978). One significant characteristic of the field's development is a "split" between qualitative-theoretical and quantitative-methodological workers in the area (Barnes, 1979; Burt, 1980; Granovetter, 1979; Wellman 1981). In part this probably reflects the multidisciplinary nature of the field. Barnes (1979) suggests, however, that diversity within the field is necessary in order to reflect adequately the diverse substantive domains. If in fact this is true, then social network analysis is neither a unified field of study nor a set of standard methodological tools. Rather, it is a loose collection of globally similar approaches to diverse phenomena which must nuture significant distinctions among its members. Some authors suggest that commonality within the field is found at the level of "paradigm" or global orientation (cf. Berkowitz, 1982; Rogers & Kincaid, 1981; Wellman, in press). This commonality contrasts with traditional research oriented toward attributes of people or ethnographic fieldwork (Berkowitz, 1982; Coxon, 1978; Mitchell, 1973; Wellman, in press).

The present status of social network analysis suggests important roles for theory construction. First, the theory-method "gap" (Granovetter, 1979) needs to be addressed by active consideration of conceptual development. Formal considerations have, in isolation, quickly outstripped substantive developments (Burt, 1980). Second, if, as Barnes (1979) suggests, network methods are appreciably impacted by the substantive context, community psychologists need to examine the modifications necessary for our foci of interest (e.g. support

systems analysis). Third, the theory-method split is accompanied by additional isolation from application issues (cf. Cohen & Sokolovsky, 1981; Snow & Gordon, 1980). Theory construction in the tradition of action research is important to consider not only for application interests, but also for the sake of research adequacy (cf. Argyris,1980; Baltes & Willis, 1977).

In sum, the development of social network analysis has strong roots in sociometry, ethnography, and, more recently, quantitative social science. The literature has clearly identified theory construction as an important scholarly activity which is lacking in the field. Community psychologists would do well to take these lessons to heart and, in the course of adopting network approaches to social support, to pay close attention to theory construction. We have a unique opportunity, as latecomers in network studies, to avoid some of the "mistakes" of our predecessors.

B. Mathematical psychology in community psychology

Mathematical psychology is unique in that as a field it is defined by the use of sophisticated mathematical methods rather than being defined by a topic area. Mathematical psychology has a broad range of potential contributions to network analysis, including measurement and scaling (e.g. Feger, 1981) and data analysis (e.g. Arabie et al., 1978). For the present discussion we will focus on contributions for theoretical development and application.

Literature on mathematical modeling (mathematical theory construction) has many contributions to make for theoretical development in support network study (see McDonald, Note 1 for a more detailed discussion). For example, the literature specifies four general methods of modeling which may be of value (e.g. Miller, 1964; Berger, Cohen, Snell & Zelditch, 1962). A "discursive" model analogizes mathematical concepts in the development of theory (e.g. "isomorphism" in Gestalt theory). An "explicational" model clarifies and extends concepts through precise

mathematical formulation (e.g. "balance" in Heider's theory for small groups). A "representational" model, on the other hand, describes specific data sets without direct substantive interpretation. A "theoretical-construct" model is the epitome of formal theory construction: all concepts are formally defined and closely tied to extensive data sets. The modeling literature thus suggests several means by which formal methods can contribute to theoretical development in support systems theory.

McDonald (Note 1) provides an example by discussing graph theoretical notions of connectedness which can be used to explicate network notions of cohesion (cf. also Barnes, 1969). Of course, any such proposals should be accompanied by acknowledgement of advantages and disadvantages of the approach. It is possible that, given the state of social network analysis, formal methods may be valuable contributions (McDonald, Note 1).

In the application of network approaches there is a set of related contributions that mathematical psychology has to offer. While overlapping with the functions of data analysis, measurement, and theory building, the functions described here have in common the purpose of facilitating communication between applied researchers and target systems. Argyris (1980), for example, notes that Lewin's use of diagrams based on his topographical metaphors were effective means of communication, instruction, and knowledge generation at an applied level. Similar to the past uses of sociograms, one has techniques of graph theory and multidimensional scaling to help formulate information in communicable form. Whether in feedback sessions, conceptual development, or as part of ongoing dialogue between researchers and other participants, the use of such techniques as a bridge between research and participant perspectives seems promising. And one is not necessarily limited to two dimensional representations. Klovdahl (1980) has suggested the use of three-dimensional computer graphics

systems for conceptual development among researchers. Potentially the same programs could be used in conjunction with research informants. To the extent one uses such methods to obtain the perspectives of informants, one is working in harmony with ethnographic principles (cf. Hirsh's (1980) use of diagrams in data collection). When employed as pedagogical devices, these methods could be an important component of intervention strategies. Again, the active consideration of theory construction issues are important to minimize the focus on technique alone or other naive errors.

C. Summary

We have outlined a few possibilites for integrating mathematical psychology and community psychology as an example of an area where theory construction considerations are important. The theory construction tasks in this instance are unique given that mathematical psychology is defined by methods rather than substantive focus. In that regard, the topics of concern are common with network analysis because some workers in that field tend to focus on methodology more than substance. Theory construction also has a role to play in substantive integration. On the one hand, the cross-fertilizations of community psychology with social and developmental areas, for example, could benefit from systematic theoretical development. This task is similar to that facing network analysts who represent myriads of substantive foci and desciplinary approaches. We suggest here that the tools of triangulation and robustness analysis (Wimsatt, 1981) or models of science as social process (e.g. Brenner, 1981; Mitroff & Kilmann, 1978) can aid applied researchers in being as systematic about theoretical development as they are about classical methodological issues like interviewer bias or sampling theory.

IV. Recapitulation

Through brief descriptions of Kurt Lewin's action research and of contemporary theory construction literature, we have identified untapped resources for community psychologists integrating application with academic psychology and social science. The example of mathematical psychology and support systems mentioned a couple instances of formal methods contributing to support systems work. The reverse is also true to the extent that support system problems provide a focus of application and a stimulus to development of formal methods (see Politser, 1980). In short, we have suggested that proactive theory construction is an important complement to methodological considerations in community psychology, especially when we seek to borrow concepts or techniques from other fields.

We want to offer some indication of the broader context which theory construction addresses in community psychology. There are two important facets of theory construction to be pursued. The first point, working toward clear, explicit conceptual formulations, is a frequently cited value in the literature, at least in principle. One of the present authors (D.H.) has seen the impact of theoretical gaps in his work on disaster management. In the Hyatt Regency hotel disaster in St. Louis, an excellent program of preventative care was initiated by the local mental health systems. People who were present at the scene of the walkway collapse were provided with group sessions for processing the event with others who were involved. A difficulty was encountered, however, when employees of the hotel were mixed with disaster workers and guests at the gathering. Clear understanding of the reactions of disaster victims to such trauma and a systems viewpoint of the people involved would suggest that hotel employees should be separated from others involved, at least during the anger phase of processing. In this instance the difficulty was overcome, but the example merely serves to emphasize the value of clear theoretical bases for

intervention. It is in such cases that one begins to see what Lewin meant by "good" theory. Examples abound of the impact of theory on intervention practice: second order change and family therapy; behavior settings and community interventions; and so forth.

There is a second facet of theory construction activity which is more controversial than is theoretical clarity. This is the explicit consideration of principles of theory building at a more abstract level of analysis. For example, some psychologists are using Pepper's (1952) classification of philosophical systems as a tool in identifying "metatheories" or general theoretical orientations. Behavioral approaches can be contrasted with ecological approaches on the basis of assumptions and global orientations of theories within each family. By using Campbell's triangulation principle, one can suggest that community psychology needs to nuture the development of theory from each of many different families of approaches. Each metatheory would complement the others by highlighting "bias" and commonalities between them. This argument for pluralism in metatheories is somewhat different from Mitroff and Kilmann's (1978) argument that applied intervention requires different metatheories than does pure research. In either case, the consideration of metatheories suggests that the rise of behavioral community psychology promises to advance community work farther than would simple variations on ecological or systems approaches. The active comparison and contrasting of divergent models is a demanding task but it offers worthwhile improvements over simplistic eclecticism from a theory construction viewpoint. As in methodological developments, there is a cost-benefit balance between "sophistication" and "practicability." We do want to suggest, however, that the current practices in community psychology are costing more than they need to because of neglected concerns in theory construction.

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